0693948

European Patent Office

SUPPLEMENTARY EUROPEAN SEARCH REPORT

Application Number
EP 94 91 6763

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	EP-A-0 389 632 (TORAY INDUSTRIES) 3 October 1990 * claims; examples *	1-5	A61M5/32 A61M25/00 A61L29/00
Y	NL-A-6 909 499 (NATIONAL PATENT DEVELOPMENT CORPORATION.) 17 February 1970 * claims; examples I-XXIV *	1-5	
A	US-A-4 373 009 (WINN R ALASTAIR) 8 February 1983 * claims *	1-5	
A	US-A-4 055 682 (MERRILL EDWARD WILSON) 25 October 1977 * claims; examples 1,2 *	1-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

A61L
A61M

The supplementary search report has been drawn up for the claims attached hereto.

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 November 1995	ESPINOSA, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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CLAIMS

1. A catheter assembly, said catheter comprising an elongate tubular member having proximal and distal ends and an inner lumen extending between these ends, said member comprising:

(a) a relatively stiff proximal segment;

(b) a relatively flexible distal segment; and

(c) a transition section between said proximal and said distal segments that is less flexible than the distal segment but more flexible than the proximal segment,

wherein at least the distal segment has been coated with a lubricious coating.

2. The catheter of claim 1 wherein the distal and the transition segment are coated with a lubricious coating.

3. The catheter of claim 1 or 2 wherein at least a portion of the proximal segment is coated with a lubricious coating.

4. The coating of claims 1, 2 or 3 in which the lubricious coating is a polymer or oligomer comprising monomers selected from at least one of ethylene oxide; 2-vinyl pyridine; N-vinylpyrrolidone; polyethylene glycol acrylates, 2-hydroxyethylmethacrylate, glycerylmethacrylate; acrylic acid and its salts, acrylamide and acrylonitrile; acrylamidomethylpropane sulfonic acid and its slats; cellulose, cellulose derivatives such as methyl cellulose ethyl cellulose, carboxymethyl cellulose, cyanoethyl cellulose, cellulose acetate, polysaccharides including amylose, pectin, amylopectin, alginic acid, and crosslinked heparin.

5. The catheter of claim 4 in which the lubricious coating is a polymer or oligomer comprising monomers selected from mono-alkoxy polyethylene glycol mono(meth) acrylates, including mono-methoxy triethylene glycol mono (meth) acrylate, mono-methoxy tetraethylene glycol mono

(meth) acrylate, polyethylene glycol mono (meth) acrylate.

6. The catheter of any one of the preceding claims wherein the distal segment has a burst pressure of at least about 195 psi and is made of a material which will show a force of about 10^{-4} pounds or less when ten centimetres of the material is deflected 10° from horizontal.

7. The catheter of claim 6 wherein the burst pressure of the distal segment is between about 195 to 220 psi.

8. The catheter of claim 6 wherein the distal section if made of a material that further will shown an additional force of about 10^{-5} pounds or less for each 1° of deflection of the material from horizontal.

9. The catheter of any one of the preceding claims wherein the proximal segment is made of a polymeric material selected from the group consisting of polyethylene, polypropylene, nylon, polyvinyl chloride, polyethylene terephthalate or other polyester elastomer or of a polymer outer core with a metallic mesh inner core and laminates thereof.

10. The catheter of any one of the preceding claims wherein the distal segment is made of a polymeric material selected from the group consisting of polyethylene, polypropylene, polyurethane, a block copolymer of polyamide, polyvinyl chloride, silicone and blends thereof.

11. The catheter of claim 10 wherein the polymeric material of the distal segment is doped with a metallic material selected from the group consisting of barium sulfate, bismuth trioxide, bismuth carbonate, tungsten, and tantalum.

12. The catheter of any one of the preceding claims wherein the transition section is made of a polymeric material selected from the group consisting of polyethylene, polypropylene, polyurethane, a block copolymer of polyamide, polyvinyl chloride, and silicone, and laminates thereof.

13. The catheter of claim 12 wherein the polymeric material of the transition section is doped with a metallic material selected from the group consisting of barium sulfate, bismuth trioxide, bismuth carbonate, tungsten, and tantalum.

14. The catheter of any one of the preceding claims wherein the distal segment is in an S-shaped or hockey stick shaped configuration.

15. A method for producing a thin hydrophilic polymer coating on a polymeric substrate comprising the steps of:

a) applying a dilute solution or suspension of a solvent and a polymer or oligomer to a selected polymeric substrate to form a sheet comprising said solvent and polymer or oligomer,

b) simultaneously removing solvent from the sheet by heating the substrate and crosslinking the polymer or oligomer to the substrate by applying a radiation source to the polymer or oligomer.

16. The method of claim 15 additionally comprising the steps of sequentially repeating steps a) and b) up to four times.

17. The method of claims 15 or 16 wherein the solvent is a polar solvent.

18. The method of claims 15, 16 or 17 wherein the solution comprises a solvent selected from ethers, alcohols, preferably methanol, ethanol or isopropanol, water and mixtures.

19. The method of claim 15, 16, 17 or 18 wherein the solution contains 0.25% to 5.0% (wt) of polymer precursor or oligomer.

20. The method of claim 19 wherein the solution contains 0.25% to 2.0% (wt) of polymer precursor or oligomer.

21. The method of any one of claims 15 to 20 wherein the polymer precursor solution contains polymers or

oligomers of monomers selected from ethylene oxide; 2-vinyl pyridine; N-vinyl pyrrolidone; polyethylene glycol acrylates including monoalkoxypolyethyleneglycolmono(meth) acrylate, monomethoxytriethyleneglycolmono(meth) acrylate, monomethoxytetraethyleneglycolmono(meth) acrylate, polyethyleneglycolmono(meth) acrylate; hydrophilic acrylates such as 2-hydroxyethylmethylacrylate, glycerylmethylacrylate, acrylic acid and its salts; acrylamide and acrylonitrile; acrylamidomethylpropane sulfonic acid and its salts; cellulose, cellulose derivatives, methyl cellulose, ethyl cellulose, carboxymethyl cellulose, cyanoethyl cellulose, cellulose acetate, polysaccharides such as amylose, pectin, amylopectin, alginic acid, and cross-linked heparin.

22. The method of any one of claims 15 to 21 wherein the temperature of the solvent removal step is between 25°C and the glass transition temperature of the polymeric substrate.

23. The method of claim 22 wherein the temperature of the solvent removal step is between 50°C and 125°C.

24. The method of claim 23 where the temperature of the solvent removal step is between 75°C and 110°C.

25. The method of any one of claims 15 to 24 wherein the crosslinking step comprises the application of ultraviolet light at a radiation density of 100 to 200 mW/cm^2 to the polymeric substrate.

26. The method of claim 25 where the crosslinking step comprises the application of ultraviolet light at a radiation density of 150 to 250 mW/cm^2 to the polymeric substrate.

27. The method of any one of claims 15 to 24 where the crosslinking step comprises the application of ionizing radiation at a radiation density of 1 to 100 $kRads/cm^2$ to the polymer precursor on the polymeric substrate.

28. The method of claim 27 where the crosslinking

step comprises the application of ionizing radiation at a radiation density of 10 to 50 kRads/cm^2 to the polymer precursor on the polymeric substrate.

29. The method of any one of claims 15 to 28 wherein the step of applying a dilute solution or suspension of a polymer or oligomer to the polymeric substrate comprises withdrawing the polymeric substrate from the dilute solution or suspension at a removal rate of 0.25 and 2.0 inches/second.

30. The method of claim 29 where the step of applying a dilute solution or suspension of a polymer or oligomer to the polymeric substrate comprises withdrawing the polymeric substrate from the dilute solution or suspension at a removal rate of 0.5 and 1.0 inches/second.

31. The method of any one of claims 15 to 28 wherein the polymeric substrate comprises at least a portion of a polymeric catheter body.